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CAUSES OF BLINDNESS IN CHILDREN

TWENTY-FIVE YEARS' EXPERIENCE OF DANISH INSTITUTES FOR THE BLIND

BY

GORDON NORRIE

During my 25 years' activity as an ophthalmic surgeon to the Royal Danish Institutes for the Blind, some 578 children have been received in the Institutes, and in the following I shall endeavour to account for the data which I have collected.

As a rule it is easy to decide whether one has to do with an affection of the cornea, the lens, the optic nerve, or other parts of the eye; whether it is a case of defects of development or whether there has been a lesion, but the difficulties arise when it comes to determining the cause of the affection itself. In some cases it is possible to obtain details from the physician who has treated the patient, but as often as not one must be content with what information can be obtained from the patient or relatives. In estimating the data it is therefore an advantage that it is the same oculist who has collected all the information and examined all the blind patients, and the great experience acquired by the ophthalmic surgeon during many years' practise at the Institutes is a factor to be taken into account.

Attempts to work out statistics in connection with the number and nature of blind persons in Denmark have been made earlier (in 1891 and 1895) but for various reasons the results were not such as to permit of comparisons with the present investigations.

The causes of blindness in children I divide into two large groups, each of which again falls into various sections.

The two large groups are

1) *congenital diseases* viz:
   a) buphthalmus, b) microphthalmus, c) other defects of development, d) retinitis pigmentosa, e) cataracta stratiformis, f) syphilis congenita.
2) *diseases occurring after birth* viz:
   a) destruction of the cornea, b) iridocyclitis and other affections of the inner eye, c) atrophia optica, d) lesions.

There is no sharp demarcation between the two groups as there are for instance no few cases of congenital atrophia optica, but for the sake of convenience it is easiest to consider these cases of atrophia together with the other cases of this ailment, particularly as it is not possible to see whether it is congenital or not.

The number of the children who have been received in the Institutes for the Blind during the 25 years are as follows:

578 children (348 boys and 230 girls).

Of these at least 88 children (51 boys and 37 girls) were born out of wedlock, that is to say over 15 %, whereas ordinarily one reckons with about 10 %.

It is extremely remarkable that there are so many more blind boys (60 %) than girls (40 %), a proportion which, by the way, is pretty much the same all over the world. It is a fact that notwithstanding more boys than girls being born, this difference is gradually balanced, and in the ages from 5 to 15 years the proportion is almost equal, viz: boys about 50,5 % and girls about 49,5 %, which is very far from the above named percentages. It will be seen from the following that it is not all causes of blindness which are responsible for greater blindness in boys than in girls, but this applies with regard to some few.

The illegitimate births are also associated with certain causes of blindness, but in the great majority of cases they play no part.

If now the figures for the individual causes of blindness are arranged in groups according to *the year of birth* of the children, and, in order not to have too small figures, collected in groups of three-year periods, we get Table No. 1.

Table I.

Year of birth	Congenital causes of blindness		Destruction of the Cornea		Diseases of the eye itself		Atrophy of optic nerve		Lesions		Total	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
1886—1888....	0	1	0	1	0	1	0	1	0	0	0	4
1889—1891....	4	1	3	1	1	2	2	2	1	1	11	7
1892—1894....	9	5	7	6	2	2	4	4	3	0	25	17
1895—1897....	9	13	9	9	2	4	10	4	4	0	34	30
1898—1900....	18	11	3	6	2	2	11	3	1	0	35	22
1901—1903....	9	6	13	9	4	2	9	9	4	2	39	28
1904—1906....	12	8	14	9	2	1	9	2	2	1	39	21
1907—1909....	6	8	5	10	5	1	15	8	2	0	33	27
1910—1912....	21	10	11	11	4	2	20	4	3	0	59	27
1913—1915....	9	5	25	14	1	1	4	4	1	0	40	24
1916—1918....	7	9	8	7	2	0	6	4	0	0	23	20
1919—1921....	1	2	5	1	0	0	3	0	1	0	10	3
	105	79	103	84	25	18	93	45	22	4	348	230
	184		187		43		138		26		578	

The fact that the numbers in the first rows, indicating blind children born in 1886—1888 and 1889—1891, are small, is due, as far as these groups are concerned, to my only having been able to include those who came comparatively late to the Institute, whereas the majority had been received before my appointment. When I was appointed in 1903 children were received from the ages of 10 to 11, but many were admitted at a later age, whereas children are now, as a rule, admitted at the ages of 7 to 8, and earlier still, at The Childrens' Home. In my data I have only included children of school age, and as far as the last groups are concerned

viz: 1916—1918 and 1919—1921, the small figures are perhaps accountable for by the children not yet having been admitted to the Institute. The figures given ought however to include all children born between 1916 and 1918, and if this proves to be the case, it would seem to indicate a considerable decline in the number of blind children and, as we shall see, much speaks in favour of such a decline of blind ness amongst children taking place in the future.

Causes of Congenital Blindness.

The causes of congenital blindness are of very different kinds. Some are due to faulty development, others are due to sickness during pregnancy, which appears to be either in the child alone or to have been transmitted to it by the mother. Some of these ailments are of a distinctly hereditary nature, whereas others show no signs of being so. On going through the individual causes of blindness these various conditions will be touched upon.

Besides defects of development I include retinitis pigmentosa, cataracta stratiformis and congenital syphilis amongst congenital disorders, whilst the cases of atrophia optica at birth will be dealt with later together with the other cases of this kind. There is perhaps something adventitious in this division, but this will always be the case however one arranges the data. For instance it is natural to reckon retinitis pigmentosa under congenital disorders notwithstanding the fact that this disease is always associated with atrophia optica. As already mentioned the differences are not so marked as to permit of strictly accurate groups being set up.

Buphthalmus or hydrophthalmus, is found at birth, or develops shortly after. The tension in the eye is far too great and in spite of treatment and the most carefully executed operations the disease, in a great number of cases, continues to develop, and the sight being weakened considerably and indeed often lost entirely. The large widely distended eye gradually becomes very thinwalled by reason of the distension, and consequently also very brittle. Moreover as it is often accompanied with great

pain it is not infrequently a very good thing for the child when one day the eye bursts through having come into contact with something. Shortly after the injury the pains cease and the child feels it as a great relief when the eye collapses altogether. In many cases the removal of the eye is advised, but one encounters often opposition on the part of the parents. In many cases the blind eye has to be removed on account of the pain suffered.

With this disease there have been:

32 children (19 boys and 13 girls).

Of these one boy and one girl were illegitimate children. It is generally said that heredity is largely responsible for this disease, but this is not confirmed by my data.

One boy had a sister with microphthalmus and an older brother who was dead but who had been blind, cause unknown. Buphthalmus and microphthalmus have doubtless no connection with each other, so that it is presumably a mere chance that these two diseases are found amongst children of the same parents. There are however no records of one single case of this disease having been hereditary; and not only this, there are records regarding 20 of the cases as to the number of brothers and sisters they had. One had no brothers and sisters and 19 had in all 97 healthy brothers and sisters. This clearly points against heredity playing any part. From this one might perhaps rather deduce that buphthalmus is due to an inflammation-like condition, or to a disease in the eye before birth, arising from poor nourishment, and not to a hereditary predisposition.

Other congenital diseases were also found in a number of these cases, as is frequently seen in cases of blindness due to various causes.

One boy had hernia ingvinalis and enuresis nocturna, another pedes equino-vari in a high degree, one girl pedes valgi dolorosi, one boy had fits and another girl was an imbecile.

Microphthalmus is due to a checking of the growth of the eye at one or other stage before birth, but doubtless always

before the eyeball has closed entirely, that is to say there is doubtless always found a coloboma, and I therefore include this in the group of microphthalmus. In all cases where I have been able to see the interior of the eye it has been clearly possible to see the coloboma and this has been possible in the majority of cases even where the section of the cornea has only been a couple of mm. It is astonishing that not infrequently in quite small eyes the sensitiveness to light has been preserved. The eye may be so small that one is in doubt as to whether there is an eye, but also the cases where one cannot discover any remains of the eye must be included in this group.

The number of blind children having microphthalmus and coloboma choroideæ, were:

35 (17 boys and 18 girls) and of these 8 (4 boys and 4 girls) only had coloboma, but not microphthalmus to any marked degree.

1 boy and 3 girls were illegitimate children.

Heredity plays only small or no part. I have mentioned that one girl had a brother with buphthalmus but that this scarcely had anything to do with heredity. There has only been one single case where there can be a question of heredity, viz: a boy whose mother's brother is said to have been born blind. However as this person left the Institute in 1873, long before medical journals were introduced, the cause of the blindness cannot now be substantiated.

It is remarkable that one illegitimate child, a boy, had a brother at the Institute who suffered from another anomaly of growth viz: palatum fissum, but his eyes had been destroyed by xerophthalmia. As to whether there possibly had also been coloboma could not be seen, as the cornea was quite destroyed.

As far as eighteen children are concerned it is recorded that they had in all 113 brothers and sisters who all had their sight.

Of other congenital diseases in these children it must be mentioned that two boys and two girls were mentally defect,

and on one boy the first joints of the third and fourth fingers of his hands and the corresponding joints on his feet, had grown together.

Atrophia oculi congenita forms a small but very interesting group. It looks as if the eye had decayed after a very serious process of inflammation, but this is hardly the case as the defect is to an exceedingly high degree hereditary.

The question concerns only nine boys.

With regard to one boy nothing is known as to heredity. He was born in America of Danish parents. He has a faint sense of light in his right eye but is totally blind in the left eye. Another boy who was born on the little Danish island Ourö, has a similar atrophy of the eye. He has also spasmodic paresis of the legs and is an imbecile. Nothing is known however as to heredity in his case.

On the other hand heredity is very clearly seen in the case of five brothers born in Copenhagen. They are all quite blind. There were two sisters who both had their sight, but who died young. The mother has her sight, but is said to have fits at times. She has had three totally blind brothers at the Institute. These three brothers are all dead, but according to the books of the Institute they were totally blind. They have no children but their other sisters, who were not blind, have daughters who have their sight, and one of them has a son who also has his sight.

Something quite similar is found in another family which originates from quite another part of the country. At the present time there are two brothers at the Institute who were born quite blind, and the appearance of their eyes is quite the same as that of the five brothers just mentioned. They have two brothers and several sisters who all have their sight, but it has been ascertained that a grandmother on their mother's side has had three blind brothers, of whom two at all events have been at the Institute. The eldest was born in 1845 and the youngest in 1849, and they both entered the Institute in 1860. There are no medical journals from that time, but there are records of them both to the

effect that they were born blind and had no sense of light. None of the three brothers were married and they are all dead. It is also related that at the farm where they were born there was an elderly blind woman, but whether she was a relation of theirs is not known. According to tradition the mother of the children treated the old woman so badly that the boys were born blind as a punishment! Finally I may state that the mother of the boys who are now at the Institute has several sisters, but none of them have children.

In addition to these congenital diseases there are a number which are far more seldom, and which in my collection of cases are only represented by some few individuals. I will refer to them briefly.

Two sisters were born blind without it being possible by examination to find anything abnormal in the eye or the optic nerve. The disease must therefore be presumed to lie in the brain. The youngest is also an imbecile. She has four sisters and brothers all of whom have their sight.

In three girls the iris was lacking, and two of them had cataract; in the one, especially on the posterior pole of the lens, and in the other partly diffused and partly collected in more dense spots. This girl also suffers from enuresis nocturna. The father of the third girl and her two younger sisters likewise lacked the iris, whereas two other children of the same parents are normal.

Two girls were albinos and the one had a sister who was likewise an albino.

Total colour blindness was found in one girl.

Congenital degeneration of the macula lutea was found in three boys and one girl. In one boy only the one eye was affected and as, with a myopia of 8.00 on the other, his sight nearly reached 6/18, he could not receive instruction as a blind patient and was therefore discharged after a short period on trial. The girl, in addition to her eye affection, suffers badly from head-shaking.

Luxation of the lens was found in five children (four boys and one girl). One boy had a deaf and dumb brother and

another suffered later from amotio retinæ of the better eye, whereby the sight of this eye declined to 2/60, and in the other there was only a sense of light.

Congenital keratoconus was found in only one instance.

Finally there was found in one girl what is doubtless an extremely seldom affection. Both eyes were dislocated behind the lower eyelid in such way that over them was an empty conjunctival pouch. The lower eyelid seemed firmly attached to the eye so that it followed the slight movements of the eye. There was a little light sense. She had five healthy brothers and sisters older than herself, whereas a younger sister, who is said to have been blind like herself, was dead.

Retinitis pigmentosa is generally a quite characteristic disease of the optic nerve and the retina, but there are also instances in which one may be in doubt whether one really has to do with this disease, or another similar affection in the interior of the eye. If however there is a rather marked hemeralopia, and a reduction of the field of vision it must be justificable to call it a case of retinitis pigmentosa.

The number of blind children with this disease has been 32 (20 boys and 12 girls).

One boy and one girl were illegitime children.

There is no doubt as to this disease being hereditary, and there are also several couples of children of the same parents at the Institute, or it is known that they have brothers or sisters who are blind. Only in four instances has it been recorded that the parents were cousins, and if possible they are always questioned as to this, but when one is unable to speak to the parents themselves on the question, the particulars obtained are not altogether reliable. As a consequence eleven children were children of only five mariages, and one meets among these children and their brothers and sisters no few who are mentally defective; for instance six out of 32 were mentally defective and a couple of them had mentally defective and partly epileptic brothers or sisters.

A couple of the children were very deaf and in this connection I am able to confirm that retinitis pigmentosa is found comparatively frequently in the deaf and dumb children at the Institute for the Deaf and Dumb.

Cataract is in almost all cases the congenital cataracta stratiformis. When I say congenital this is in many cases not quite correct as the cataract at times only appears when the child has reached a certain age. I have myself had opportunities of examining children who had no cataract, but who some years later were found to have a well developed cataract. It is also often said in families in which cataract is hereditary, that the cataract commenced at such and such an age.

The number of children at the Institutes who were blind from cataract amounted to:

41 (27 boys and 14 girls).

Four boys and three girls were illegitimate children.

In many cases weak sight accompanies cataract, so that even a completely successfull operation only gives poor sight. In no few cases remnants of the cataract will remain after the operation, but can be removed by repeated operations. At the Institute several cases have been operated upon and four of these have since been discharged as having their sight. But in at least 10 cases, doubtless many more, inflammation has arisen after operations performed by the cleverest opthalmic surgeons, inflammation which has destroyed the eye, and even given rise to sympathetic ophthalmia. In several cases the eye has had to be removed. This will presumably be more seldom in the future as it is now possible to a far greater extent than before to avoid infection. It also proves that of the ten cases in which the eye has undoubtedly been destroyed as a result of the operation, the three were born in 1893, one in 1896, one in 1902, one in 1904, two in 1910 and two in 1913, but since that time there have been no further instances of such mishaps.

The hereditary transmission of congenital cataract plays a very important part. In a medical weekly I gave in

1896 an account of two families in which cataract was hereditary. The one of these families, which have later been the object of the investigation made by *Kirstine Lehmann* (1918), had at that time at least 30 members having cataract, the first of whom was born in 1798. Two sisters of this family are included in my cases. The second family I mentioned had 40 cases of cataract out of a total mumber of 69 persons, and there appears to be a possibility of two boys who are at the Institute being members of this family.

The last named family showed the peculiarity that the female progenitor only developed cataract in her old age. In the next generation the sight was lost of the age 40, in the following at the age of 30, in the fourth generation at the age of 7 and finally in the fifth generation already in infancy. Something similar is stated in conneetion with a couple of the pupils at the Institute, who come from quite a different part of the country. Regarding one boy it is stated that his mother had weak sight and that a brother of his mother, born in 1872, had been at the Institute. On looking up the records it appeared that his mother was operated upon at the age of 28 for cataract in 1873. She had a brother who developed a cataract at the age of 14, and she had three sisters, all of whom had their sight. He himself had twelve sisters and brothers who all had their sight.

As complications it should above all be mentioned that no less than 8 children (5 boys and 3 girls) were mentally deficient, including a young illegitimate negress from the West Indian Isles. One boy who was mentally deficient, was also found to have the testicles situated in the inguinal canal.

In the case of hereditary cataract it must be remembered that total blindness is comparatively seldom, the majority having what may be termed guiding sight, and no few are able to receive instruction as weaksighted. In families where cataract is hereditary, there are generally several persons with cataract but so slightly developed that they are able to get along all right, and for this reason not much is seen of them.

Syphilis congenita. Congenital Syphilis does not play any

great part. This sounds rather surprising, as the assumption is pretty general that syphilis is a very common cause of blindness in children. Neither can it be denied that this disease may be responsible for several of the cases of blindness, which are dealt with here under atrophia optica and iridocyclitis, but in these cases it has not been possible to demonstrate the presence of syphilis.

In later years the blood reaction tests (Wassermann's and others), have furnished a valuable help in diagnosis, but it is by no means seldom that these tests are negative in cases where a congenital syphilis must nevertheless be assumed to exist. Before these tests were known the diagnosis could only be based upon the clinical features, and the course of the disease.

The number of cases of blindness resulting from congenital syphilis has been in all:

16 children (6 boys and 10 girls).

One boy and two girls were illegimate children.

The most frequent eye-disease in the case of congenital syphilis, causing blindness, is the diffuse parenchymatous keratitis, i. e. an iridocyclitis with diffuse opacity of the cornea. This corneal affection disappears in most cases and this is the reason why so few cases come to the Institute; and even amongst those who are received as blind, because they cannot follow ordinary school instruction, the affection sometimes clears up and they recover their sight. This happened to one boy, but on the other hand he became quite deaf and developed a serious defect of his palate. Deafness likewise appeared in another boy and two girls. As far as the boy is concerned it was necessary to teach him the finger alphabet which he did by touch, as he could neither hear nor see.

Two brothers had an advanced disseminated choroiditis, and one boy and a girl also atrophia optica.

The modern energetic treatment of mother and child will in all probability further reduce the importance of syphilis as a cause of blindness.

Blindness acquired after birth.

Blindness due to causes which first appear after birth falls in several groups: destruction of the cornea, iridocyclitis and other affections of the eye, atrophy of the optic nerve, and injuries.

The destruction of the cornea may again be due to various causes. It is easy enough to admit that the cornea is destroyed, but one cannot see what has caused the destruction. Here one has to build upon information from the medical man or, failing this, from the family, and such information cannot always be relied upon. However, as a rule one is able to ascertain the age of the child, when the blindness came on, whether the child was ill at that time, and, if so, what was the matter with it. There still remain however several cases in which uncertainty exists, and in which one must draw one's own conclusions on the basis of the incomplete information, or entirely give up finding the cause. This however applies only in ten cases.

Destruction of the cornea was found in:

187 children (103 boys and 84 girls).

On closer analysis it generally proves that one can very well form an idea as to the cause of the blindness, as there are some diseases about which one can always be fairly certain, and these we will begin with.

Blennorrhoea neonatorum. This disease which is due to infection with gonorrhoeal pus, generally immediately after or during birth, has always played a very great part, and there are countries where it is considered the most important cause of blindness. It is generally reckoned that about 20 % or more of all blind children have lost their sight through this disease. Formerly this was also the case here in Denmark, but from the autumn of 1900 it was possible, after I had worked for it during fifteen years, to have it made obligatory that midwives should instil a solution of silver-nitrate into the eyes of every child immediately after birth, the so-called

Credés method. However, in this country a 2 % solution is not used, but as a result of Professor *K. K. K. Lundsgaard's* investigations a solution of 1:150. Thanks to the excellent staff of midwives here in Denmark, the adoption of this method has given a result which could not be better, as will appear from the following.

The number of children whose blindness was due to blennorrhoea neonatorum is —

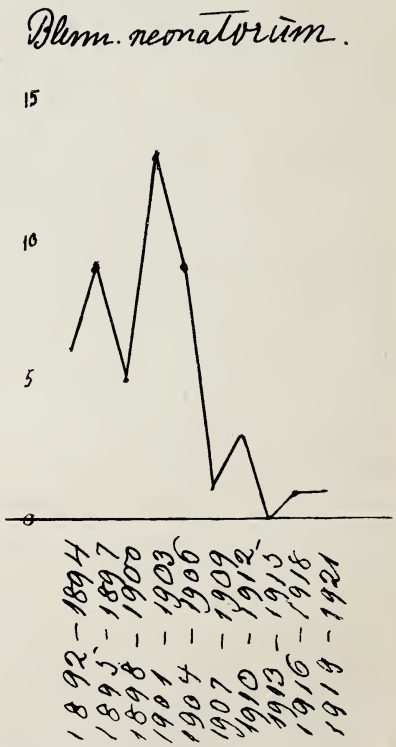
49 children (28 boys and 21 girls).

Of these 18 (12 boys & 6 girls) were illegitimate children.

When grouping the children according to their year of birth, which in this case will also be the year in which blindness occurred, and showing these in three-year period groups we get:

Table II.

	Boys	Girls	Total
1886—1888	—	—	—
1889—1891	—	1	1
1892—1894	5	1	6
1895—1897	4	5	9
1898—1900	1	4	5
1901—1903	8	5	13
1904—1906	6	3	9
1907—1909	—	1	1
1910—1912	2	1	3
1913—1915	—	—	—
1916—1918	1	—	1
1919—1921	1	—	1
	28	21	49



It might be expected that several years would elapse before the midwives had become so accustomed to dripping the eyes of new born children that they never forgot to do this, and it also proves that of the children born during the period 1901—1903 there are even very many blind owing to their eyes not having been dripped; but during the following three years the number declines very considerably, and since 1912 there has so far only been two cases at the Institute of children blind from blennorrhoea neonatorum.

There are however ten children with regard to whom one cannot with certainty exclude the possibility of eye inflammation at birth. Of these only one girl is an illegitimate child. These ten children were born respectively in the following ten years: 1890, 1893, 1895, 1897, 1901, 1907, 1909, 1913, 1914 & 1915, and even when including these we only get three cases during the period 1913—1915.

The large number of illegitimate children is not surprising, as the disease is gonorrhoea,

Scrofulosis can undoubtedly give rise to blindness by the destruction of the cornea, but this does not happen frequently and for many years we have not seen any cases where either the diagnosis made by the physician sending us the patient, or that made on the examination at the Institute, has substantiated blindness from this cause. 13 children (seven boys and six girls) have been treated for serious scrofulosis at the Refsnæs Hospital on the coast, and the diagnosis was made there; the last two cases were of children born in 1912. This cause of blindness is therefore no longer reckoned with, although one naturally cannot be certain that some few cases may arise. Tuberculosis in the eye now shows itself more frequently as an iris tuberculosis, as we shall see later.

That which is generally called scrofulous inflammation of the eyes, phyctenular keratitis, has in quite the majority of cases nothing to do with scrofulosis, but is due to head lice (pediculi capitis) which not only cause diseases of the eyes but »scrofulous« sores and swollen glands. When the lice are got rid of the disease disappears. This affection does

not make the children blind but only weakens their sight. Already as early as in 1886 this matter had my attention, and as soon as I felt certain in my view I have constantly urged this both verbally and in writing.

Infectious diseases are often said to be the cause of blindness, it being stated that blindness has occurred during or in connection with one or other serious illness. This has been the case with —

26 children (13 boys and 13 girls).

of whom no less than five boys and one girl were illegimate children.

The diseases at issue are:

Pneumonia, in 9 children (6 boys and 3 girls) all in the age of 6—9 months.

Morbilli, in seven children (4 boys and 3 girls) in varying ages up to eight years.

Tussis convulsiva in five children (two boys and three girls); four of them were under one year and one seven years old.

Influenza in three girls, two of whom were under one year.

Diphtheria in one boy two years old.

Other diseases in two cases.

How eye-diseases appear in such cases I do not know, as I have never had occasion to see this, but as far as diphtheria is concerned, it is doubtless a diptheritic inflammation, which, as is well known, is extremely dangerous for the sight. As far as the other diseases are concerned, one thinks principally of xerophthalmia, as during serious illnesses the children are so poorly nourished that conditions become favourable for the development of xeropthalmia. Under any circumstances it ought always to be seen to that children during serious infectious diseases are given whole milk, howewer ill they may be.

Xerophthalmia. There now remains a number of cases of blindness with the complete destruction of the cornea, which are not due to the above named serious illnesses, but which cause much trouble, as in most cases a definite diagnosis

cannot be given with regard to the disease which has caused the destruction of the cornea. One has nothing more to build upon than the statements of the parents, or the doctor, as to when the disease has arisen. Often the physician who sends the patient to the Institute has not treated the child when it was attacked by the eye disease but has only seen it a long time after. The statement of the parents as to the age of the child when it became blind is often very indefinite. It may however be taken for granted that if the child has become blind through blennorrhoea neonatorum they remember it and say that it became blind shortly after birth; or they will say that the child was born blind.

If the data concerning these cases are investigated more closely one is able to draw several conclusions. In all —

99 children (55 boys & 44 girls)

are concerned.

No less than 24 children (13 boys and 11 girls) were illegitimate.

Information is lacking as to when blindness has occurred in eleven cases, to which I shall briefly refer later.

There thus remains —

88 children (50 boys and 38 girls).

If one now investigates at what age blindness has occurred it proves that it has appeared during

the 1st year of life	in	56	children,	31	boys	and	25	girls;
1—2 years	-	26	—	15	—	—	11	—
2—3 —	-	3	—	1	—	—	2	—
3—4 —	-	3	—	3	—	—	—	—
		88		50			38	

at the age of

Thus, with a few exceptions, the question concerns infants under two years and, in the great majority of cases, before they are one year old. Arranging the cases according to the year in which the disease has arisen grooping them in three-year periods, we get the following table:

1895—1897	2	boys	—	girls	total	2
1898—1900	1	—	—	—	—	1
1901—1903	3	—	—	—	—	3
1904—1906	6	—	6	—	—	12
1907—1909	4	—	4	—	—	8
1910—1912	4	—	7	—	—	11
1913—1915	15	—	12	—	—	27
1916—1918	10	—	8	—	—	18
1919—1921	5	—	1	—	—	6
	50	—	38	—	—	88

It will at once be seen that by far the greater part of the cases occur in the years 1913—1918, and the majority, perhaps all of them, arise from xeropthalmia which during the unfavourable nourishing conditions during the war was very wide-spread in Denmark. After the war this disease seems to be well on the decline and it should no longer be a cause of blindness, as the physicians must now be presumed to have their attention directed to it. However one cannot expect this cause of blindness to disappear entirely, for it is not seldom that the doctor is called in too late, and if the cornea is once attacked the prospects of saving the child's sight are not great. While it is quite certain that the greater number of the cases of blindness here mentioned are due to xerophthalmia, it is not certain that they are all of this origin. This question cannot, however, be fully elucidated, as it is only in later years that the disease has become more generally known amongst physicians. Of the six boys who were born before 1904 no less than four were illegitimate children, and this would seem to indicate that their disease has been blennorrhoea neonatorum, However, against this is the definite statement that the disease has arisen when the child, in one case, was three months old, in two cases six months, and in one at the age of three years. One of the children had in addition a palatum fissum, and the fifth child was born in wedlock but the parents were paupers. The re-

markable number of illegitimate children in this group is also easely accounted for by the fact that the majority of the illegitimate children are foster children who often live under very unsatisfactory conditions. Moreover, almost all the children were from very poor homes. As mentioned, cases of blindness which arise through infectious diseases, are presumably due to xerophthalmia, and also here there were a remarkable number of illegitimate children.

There remain 11 children, five boys and six girls, regarding whom information is lacking. About the one it is however known with certainty that the cause of blindness was xerophthalmia, but it is not stated at which age the blindness occurred. Six were born long before the war, before I was aware that it could be of importance to ascertain the age of the child at the onset of blindness, and one was not examined at all, because he only remained one day at the Institute, as he could not bear having to wash himself in cold water and was particular as to food, and because, as he put it, he was disgusted at the choice language of the older pupils! The ten are, I may say, mentioned as possible cases of blennorrhoea neonatorum.

Xerophthalmia has played a great part, doubtless far greater than we have thought, and if it is so there is the best hope that this cause of blindness will gradually become more and more seldom. There should be no cases of blindness arising from xerophthalmia.

Iridocyclitis and other intraocular diseases.

While destruction of the cornea, and atrophy of the optic nerve, play a very great part as causes of blindness, this is to a far less degree the case with diseases in the eye itself. The diseases can only with difficulty be determined and the cause of disease in the eye in a great number of cases cannot be explained.

Iridocyclitis is the disease most frequently met with. This applies of:

32 children (17 boys and 15 girls).

Of these three boys and two girls were illegitimate children.

The cause of iridocyclitis is doubtless in most cases tuberculosis or syphilis. In the case of five boys and four girls the disease was known, definitely to be of tubercular origin, whereas in the others nothing definite was known. The disease often develops insidiously with many minor attacks. In all probability syphilis is responsible for a number of cases, but either these cases have appeared before Wassermann's test was known, or the latter has at the time the child came to the Institute, been negative.

Even if one groups the cases in different ways it is not possible to find definite points permitting of a further explanation. In the future it will doubtless be possible to obtain better particulars about this group, as most children suffering from inflammation of the eyes for any length of time will be treated by ophthalmic surgeons.

Of other eye ailments, 3 boys and two girls were found to have myopia in a very high degree, the one with amotio retinæ, which was also found in 3 other boys. One had glaucoma and three had tumor in the eye.

Atrophia optica.

This diagnosis is very easy to make, but it is nothing like so easy to decide what has caused the atrophy. The group is very large and comprises:

138 children (93 boys and 45 girls)

8 boys and 6 girls are illegitimate children.

In order to obtain a better survey, one may try to divide the cases into the following subdivisions:

1) congenital forms 2) premature ossification of the cranium 3) tumors in the brain 4) meningitis 5) fracture of the cranium 6) neuritis optica 7) epilepsy and 8) unknown causes.

This grouping is however not particularly satisfactory but on some few points it gives interesting information.

1) amongst the congenital forms which comprise 25 cases (16 boys and 9 girls) heredity plays some part. It

may thus be mentioned that one boy's mother is said to have had a blind child which was illegitimate. About two brothers it may be stated that they had two older brothers whose sight was weak. Further a boy and his sister are said to have had atrophia optica, seen by an oculist, but owing to complications in the transparent media the eye ground could no longer be perceived. The parents were relatives but there were five healthy brothers and sisters. Another boy, whose parents were likewise relatives, had a younger blind brother, and finally there were two mentally deficient members of one boy's family having atrophia optica, in addition to which one of them had also palatum fissum, while two others had died quite young. One girl had congenital syphilis.

Three boys had alterations in the eyeground outside the optic nerve, so that it is possible they ought rather to have been included under retinitis pigmentosa.

Finally one girl had myxoedema in a very high degree, six toes, weak heart, shook badly, could not help herself and was extremely dull.

2) Steeple-skull and the premature ossification of the cranium is a strange disease, in so far as it seems that it occurs very seldom in girls. At the Institutes for the Blind I only found the disease in two girls, but in 25 boys. It is doubtless not known what is the reason for this but the numbers are so striking that it must be taken for granted that there is a definite cause.

3) Tumor cerebri is a very difficult diagnosis to make, and it is therefore somewhat uncertain whether it is correct to say that the number of cases was:

10 children (4 boys and 6 girls)

In the six cases the diagnosis has been made at the large hospitals, where operations have been performed, but in the four cases I have only opined the probability or, at all events, a possibility, of there being a tumor in the brain, but it may have been another disease of the brain.

I will briefly refer to a couple of these cases.

A boy developed hydrocephalus when two years old, brain symptoms when four years old. When he came to the Institute his gait was very unsteady and tottering. He could only rise with great difficulty, and could hardly stand with his legs together. He died at the age of twenty.

One girl had an acute brain disease when seven years old and one or two years later complete paralysis in both legs, and partly in both arms. This paralysis disappeared but the blindness of course remained. She died at the age of twenty-four.

One girl is said to have hurt her head by a fall, but she was well until she was three years old. One night she cried out in pain and was taken to the hospital where a protrusion was found on the cranium, atrophia optica, but no choked disk. A trepanation was undertaken, but nothing was found. When she was 13 years old, while at the Institute, she vomited twice one day and two days later suffered from headache, wherefore she was placed in the sickroom. Later in the same day her mind commenced to wander. Her cheeks suddenly became red and after becoming unconscious, she died without any convulsive attack.

An illegitimate child (girl) with a strongly pronounced hypermetropia, eccentric fixation, squint and nystagmus, doubtless had atrophia optica when five years old. She came to the Institute when 10 years of age, V. 3/60. On the 29th April 1912 she became ill and was placed in the sickroom, temperature 37,4 C. Two days later 1st May, her respiration was rapid but deep and free, pulse not accelerated, temperature 36,5, nothing abnormal on examination of chest. On the 2nd May temperature 36,3 in the morning, at 2 p. m. 35,9, respiration very rapid, pulse weak, intermittent. She was not very clear in her mind. Traces of albumen in the urine. 3rd May, temperature 34,9 in the morning, at 3 p. m. 32,4, at 6 p. m. 32,4 respiration calm, deep, 28, no cyanosis, pulse 84 regular, almost unconscious, 4th May at 7 a. m. she had two fits and died 20 minutes later.

4) Meningitis was stated as the cause in —

37 children (23 boys and 14 girls).

The inflammation is said in one case to have arisen in connection with tussis convulsiva, in two cases with morbilli, in three cases of ear disease, in three cases with inflammation of the lungs and in three cases with influenza.

5) Injuries have been given as the cause in five boys, in two at the age of 3 by a fall from a bench or chair, and in one boy at the age of 6 after being run over by a bicycle, and in one boy 10 years of age by a fall from a cart. Finally one is said to have become blind at the age of three years as the result of maltreatment.

6) Consequences from neuritis optica have only been recorded in two cases but this is doubtless due to the fact that this diagnosis can only be made by an oculist who in time has the child under treatment; but such diseases in the optic nerve are doubtless found very seldom in children. The one of these two boys was 14 years old, 142 cm in height, weighed 65,5 kilos, and was very backward. Of his 16 brothers and sisters, nine were dead, one was epileptic and one weaksighted.

The other boy when 15 years old had neuritis optica, his sight being reduced to a minimum. The mother had two brothers and a sister who became blind at the age of 20, one brother became blind at the age of 6 and two died a few days after birth.

7) Two boys were epileptic and mentally deficient.

8) With 30 children (17 boys and 13 girls) no cause is known, the sight having weakened gradually without other symptoms. In 10 of these this has taken place while they were three or four years old and for the oldest at the age of 13—14.

The prospects of reducing the number of cases of blindness due to atrophia optica are at present poor.

Lesions.

This group comprises:

26 children (22 boys and 4 girls).

One 10 years old boy was injured with acid.

One boy of two years had fallen into a lime pit.

One boy 5—6 years of age found on the road some unslaked lime, put it in a box and poured water over it. Both eyes were removed at the hospital. He had severe scars on his face.

All the other 23 children became blind owing to ophthalmia sympatica.

The most frequent injuries had been caused by pointed instruments such as knives, scissors etc. (thirteen cases). As a result of shooting (bow and arrow, fowling piece, and also fireworks — three cases). Four cases were due to falls, and only one case to some foreign object having got into the eye. In one case no information was given about the injury.

In five cases it is stated that the children have been treated at a hospital before there could have been any question of ophthalmia sympatica.

It cannot be sufficiently emphasized that one ought not to wait too long before removing the injured eye, as one thereby secures the child against becoming blind. There is so much the less reason to hesitate in removing the eye, as, an injured eye in most cases only retains very little sight. With one eye it is possible to do almost the same as with two — but blindness in both eyes is a very great misfortune.

Resumé.

In the course of the last 25 years the Institutes for the Blind, in Denmark, have received in all 578 children (348 boys and 230 girls) i. e. 60 % boys and 40 % girls, whereas the proportion between boys and girls in the population

at the age of between 5 and 15 years, is about 50.5 % boys against 49.5 % girls.

The number of illegitimate children is rather great, and this is due partly to the comparatively many cases of blindness originating from blennorrhoea neonatorum in children born outside wedlock, and partly to there being comparatively many cases of blindness due to xerophthalmia, among illegitimate children. The first is easily explainable in that the unmarried mothers are more exposed to gonorrhoea than the married mothers, and the second by the fact that illegitimate children are, as a rule, foster children who are often poorly attended to on account of the mothers not being able to pay for good nursing.

The congenital diseases which give rise to blindness were found in almost one third of all the blind patients, viz: in 184 (105 boys and 79 girls).

As far as the more important congenital causes of blindness, are concerned viz: buphthalmus, (in all 32 children, 19 boys and 13 girls) and microphthalmus, (in all 35 children, 17 boys and 18 girls) heredity plays no part, as there was not found one single instance of two cases in the same family; and, moreover, the inquiries made gave the result that 36 of these children had together 203 brothers and sisters who all had their sight.

With regard to complete atrophy of the eyes, which is very rare, heredity plays a rather important rôle, and, further, it seems as if this disease appears only in boys. Heredity plays a very great part with regard to retinitis pigmentosa and cataracta stratiformis, it having been possible in the case of one family to trace the disease back some 130 years. Of these diseases 32 children (20 boys and 12 girls) were found to have retinitis pigmentosa, and cataracta stratiformis was found in 41 children (27 boys and 14 girls).

Syphilis is transmitted in quite another way from mother to child. This disease, however, does not play so important a rôle with regard to blindness in children as is generally

assumed. Only 16 children (6 boys and 10 girls) are concerned.

To these come perhaps some few cases of atrophia optica, and of iridocyclitis, but these figures cannot be substantiated.

The diseases occurring after birth which cause blindness were found in two thirds of the total number, but these again fall into large groups.

Destruction of the cornea. This was found in 187 children (103 boys and 84 girls), or, in other words, in slightly over one third of the total number of blind children.

The causes of the destruction of the cornea may again be divided into several groups.

Blennhorrhoea neonatorum was found in 49 children (28 boys and 21 girls). Thanks to the carrying through of the measure that on every birth taking place the midwife drips into the eye of the child a solution of nitrate of silver, (1 : 150), only two children have become blind from this disease since 1912. Even when reckoning some cases concerning which the information given is unreliable, there have only been three cases more after 1912. This cause of blindness which in most countries is considered as being responsible for at least 20 % of all cases of blindness, is not now reckoned with at all in Denmark.

Scrofulosis as a cause of destruction of the cornea is seldom met with nowadays. It has only been given as the cause of blindness in 13 children (7 boys and 6 girls) none of which cases has occurred in children born after 1912.

Attention is called to the fact that what is generally termed scrophulous eye disease, the often recurring phlytenular keratitis, which seldom leads to blindness but often to weak sight, often accompanied by sores in the face and in the skin of the head and also by glandular swelling, have as a rule nothing to do with scrofulosis, but are due to lice, pediculi capitis. When the latter are got rid of the disease quickly disappears, but returns with the lice.

As far as a large number of children are concerned, in all 88 (50 boys and 38 girls), the destruction has taken place

during the first couple of years of the child's life, i. e. from the age of about two months to two years, but seldom at a higher age. In the great majority of these cases the basic disease has been Xerophthalmia which is due to the lack of A Vitamins. Most of these cases occurred during the great war when the food conditions were unsatisfactory and nourishment consequently poor. It is particularly the lack of whole milk which is the cause of the disease. Of late years the disease has been on the decline, after the attention of the medical men and the people themselves has been directed to it.

In all probability it is also xerophthalmia which causes blindness in the course of serious infectious diseases, and this has been the case with 26 children (13 boys and 13 girls). The attention of the practising physicians ought therefore to be directed to the necessity of the children receiving whole milk during serious infectious diseases. It is a relatively small amount that is required in order to prevent xerophthalmia.

Iridocyclitis is given as the cause of blindness in 32 children (17 boys and 15 girls). In the majority of cases this disease is due to tuberculosis or syphilis, most frequently tuberculosis, as the syphilitical inflammation, which is rather frequent, does not, as a rule, leave permanent blindness.

A very large group is formed by atrophia optica, this being the cause of blindness in 138 children (93 boys and 45 girls). That is to say, about one fourth of all the blind children, are blind from this cause. It can be easily recognized by the oculist, but it is very difficult to substantiate the reason for it. A very important factor is the premature ossification of the skull, but the strange thing about it is that whereas the disease was only found in two girls, it was found in no less than twentyfive boys. — In 16 boys and 9 girls the atrophy was stated to be congenital, not seldom hereditary, and in some ten cases there was a tumor cerebri, as far as it was possible to judge. Meningitis had caused blindness in 37 children (23 boys and 14 girls). In most of

the other cases it was not possible to determine the cause, and in 30 children (17 boys and 13 girls) it was especially stated that the sight had gradually decreased without there being any other symptoms.

Finally, lesions were the cause of blindness in 26 children (22 boys and 4 girls). In 23 of these blindness was due to ophthalmia sympatica. This can be avoided by the injured eye being removed in time.

Trachoma is very seldom in Denmark, being generally imported, and there has not been a single case of blindness from this disease during the last twenty five years.

Variola is also very seldom in Denmark as vaccination has been obligatory since 1810. There has not been a case of blindness from Variola during the last 50 years or more.

If it is now asked *what can be done to reduce the number of cases of blindness and to prevent blindness*, it may be said:

As far as hereditary congenital diseases are concerned, one can only recommend parents to be careful in having children, but this is scarcely likely to have any material effect. One can further recommend them not to have children with relatives in whose family there is the same hereditary predisposition, as the prospects for the possible children of such marriages are naturally bad when the hereditary predisposition is found in both parents. This perhaps applies particularly in families where retinitis pigmentosa is found.

Congenital Syphilis can in most cases be combated when the mother during pregnancy, and the child immediately after birth, receive expert treatment, and there is therefore a prospect of this cause of blindness coming to play a still lesser part than hitherto.

Blindness owing to blennhorrhoea neonatorum, ought no longer to exist. It has proved in Denmark that with a clever, reliable and welltrained staff of midwiwes this important cause of blindness can be abolished. Midwives must be instructed carefully in the use of the method. It should be

so well introduced that it is inconceivable they should in any case omit to drip the eyes of a new-born child. They must be got to realize the importance of this measure, and the responsibility they incur in omitting to perform this simple operation. When once the midwives have realised what is at stake, the best results can be expected.

The so-called scrofulous diseases are to be treated by combating head lice. Even if there are physicians who will not believe my assertion about the causal relation between the lice and the inflammation of the eye, I have never yet met any who have not admitted that the getting rid of lice cannot do any harm. Therefore get rid of the lice by all means, and the riddance of the eye affection will follow by itself!

Xerophthalmia ought no longer to cause blindness as soon as the physicians realise that it is due to the lack of A vitamins. Children must have their whole milk also while suffering from serious infectious diseases, and they will then not develop xerophthalmia. If the disease is in its commencement and it is seen that the cornea is dry, a little milk or a little cod liver oil will do wonders. Once the cornea is attacked it is doubtful whether anything can be done.

As far as the various diseases in the eye itself and the optic nerve are concerned, it is unfortunately so far not possible to do anything effective in the way of prevention.

In the case of lesions it should be borne in mind that the injured eye ought to be removed in time; one should not wait longer than six weeks after the injury, and in some cases this is too long. If the injured eye is not completely settled by that time it ought to be removed. The sight will hardly be good and there is great risk of the other eye being affected. If the sound eye is once attacked the child practically speaking always becomes incurably blind. If the eye is removed in time the sight of the one eye is saved, and with one eye one is able to manage almost just as well as with two.

In the future there ought to be only two large groups representing causes of blindness viz: the congenital diseases and atrophia optica, whereas the group which at present is the most prominent viz: the destruction of the cornea, ought to be reduced very considerably. In the course of the next twenty five years the picture ought to be entirely changed and the number of blind children reduced very much comparatively.

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